APPENDIX 8.1G

BACT Analysis

BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

Rule 2201 requires the application of BACT to any new or modified emissions unit if the new unit or modification results in an increase in permitted daily emissions (defined in §3.26 as Potential to Emit) greater than BACT trigger levels. BACT is the most stringent emission limitation or control technique of the following:

- Achieved in practice for such emissions unit and class of source; or
- Contained in any State Implementation Plan approved by the Environmental Protection Agency for such category and class of source. A specific limitation or control technique shall not apply if the owner or operator of the proposed emissions unit demonstrates to the satisfaction of the APCO that such limitation or control technique is not presently achievable; or
- Contained in an applicable federal New Source Performance Standard; or
- Any other emission limitation or control technique, including process and equipment changes of basic or control equipment, found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source.

The combustion gas turbine emission rates exceed 2 lb/day of NOx, VOC, and PM_{10}, and SOx. Therefore, BACT will be required for these pollutants, as discussed in the following sections. In accordance with Section 4.2.1, BACT for CO is not required for new or modified sources of air pollution if the post project potential to emit is less than 200,000 lb/yr. As shown in Section 8.1.5.1.1, Table 8.1-20, the post project potential to emit for CO is well below this level. Therefore, BACT for CO is not required. However, the combustion gas turbine will be equipped with an oxidation catalyst to comply with BACT. Therefore, CO BACT is discussed in the following section.

As summarized in the following sections, this BACT analysis concludes the following:

- NOx emission limit of 3 ppmv @ 15% O_2 constitutes BACT for natural gas-fired simple cycle combustion gas turbines. At a design exhaust NOx concentration of 2.5 ppmv at 15% O_2, the proposed combustion gas turbines will comply with the BACT NOx emission limit.

- VOC emission limit of 2 ppmv @ 15% O_2 constitutes BACT for natural gas-fired simple cycle combustion gas turbines. At a design exhaust VOC concentration of 2 ppmv at 15% O_2, the proposed combustion gas turbines would comply with the BACT VOC emission limit.

- CO emission limit of 6 ppmv @ 15% O_2 constitutes BACT for natural gas-fired simple cycle combustion gas turbines. At a design exhaust CO concentration of 6 ppmv at 15% O_2, the proposed combustion gas turbines would comply with the BACT CO emission limit.

- BACT for PM_{10} and SOx is the use of natural gas as the fuel source.

A. Nitrogen Oxides – Combustion Gas Turbine

The BACT analysis performed for NOx control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle combustion gas turbines;
- Review of federal NSPS for natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle combustion gas turbines.

1. Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- CARB;
- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD); and
- South Coast Air Quality Management District (SCAQMD).

CARB's BACT Clearinghouse contained determinations by the Sacramento Metropolitan Air Quality Management District (SMAQMD) that specified water injection and SCR achieving an emission limit of 5 ppmv @ 15% O_2 as BACT for the following facilities:

- Carson Energy Group cogeneration plant in Sacramento, California; and
- Sacramento Cogeneration Authority cogeneration plant in Sacramento, California.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a NOx limit of 5 ppmv @ 15% O_2 has been "achieved in practice." This BACT guideline was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999).

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a NOx exhaust concentration of 5 ppmv @ 15% O_2 constituted BACT that had been achieved in practice and 3 ppmv @ 15% O_2 constituted BACT that is technologically feasible.

The SCAQMD database did not contain BACT guidelines for NOx emissions from natural gas-fired simple cycle combustion gas turbines.

2. Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in

Title 40 CFR Part 60 Subpart GG. As presented previously in Section III.B.1, the NOx emission limit applicable to the proposed combustion gas turbine will be 102 ppmv @ 15% O_2.

3. District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVUAPCD, and SCAQMD were reviewed to identify the NOx standards that govern existing natural gas-fired simple cycle combustion gas turbines.

- BAAQMD adopted Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 9-9 specifies an efficiency-adjusted NOx emission limit of 12.2 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW, rated at 10,073 Btu/kW-hr, and equipped with SCR.

- The SMAQMD adopted Rule 413 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 413 specifies a NOx emission limit of 9 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW and equipped with SCR.

- The SDCAPCD adopted Rule 69.3.1 (Stationary Gas Turbine Engines – Best Available Retrofit Control Technology) to limit NOx emissions from these devices. Rule 69.3.1 specifies an efficiency-adjusted NOx emission limit of 12.2 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW, rated at 10,073 Btu/kW-hr, and equipped with post-combustion NOx controls.

- The SJVUAPCD adopted Rule 4703 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 4703 specifies an efficiency-adjusted enhanced Tier II NOx emission limit of 3 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW, rated at 10,073 Btu/kW-hr, and equipped with SCR (April 30, 2008 deadline).

- The SCAQMD adopted Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 1134 specifies an efficiency-adjusted NOx emission limit of 12.2 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated no less than 10 MW, rated at 10,073 Btu/kW-hr, and equipped with SCR.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the NOx BACT determination of 3 ppm @ 15% O_2 for the natural gas-fired simple cycle combustion gas turbines made in the SJVUAPCD BACT guidelines reflects the most stringent NOx emission limit. Therefore, BACT for NOx emissions for natural gas-fired simple cycle combustion gas turbines is 3 ppmv @ 15% O_2. The MEGS facility will be designed to meet a NOx level of 2.5 ppmv @ 15% O_2.

B. Carbon Monoxide – Combustion Gas Turbine

The BACT analysis performed for CO control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle combustion gas turbines;
- Review of federal NSPS for natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle combustion gas turbines.

1. Published BACT Guidelines

As discussed previously in Section IV.A.1, published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- CARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a CO limit of 10 ppmv @ 15% O_2 has been "achieved in practice." CO emissions from the gas turbine will meet the District BACT requirements. The CO emission rate from the gas turbine at the outlet of the exhaust stacks will not exceed 6 ppmvd, corrected to 15% O_2 during base load operations.

A BACT guideline of 6 ppmv @ 15% O_2 was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999). As discussed above, the CO emission rate from the proposed gas turbine at the outlet of the exhaust stacks will not exceed 6 ppmvd, corrected to 15% O_2.

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a CO exhaust concentration of 6 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

The SCAQMD database did not contain BACT guidelines for CO emissions from natural gas-fired simple cycle combustion gas turbines.

2. Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in Title 40 CFR Part 60 Subpart GG. This NSPS does not specify an emission limit for CO.

3. District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, SDCAPCD, SJVUAPCD, and SCAQMD were reviewed to identify the CO standards that govern existing natural gas-fired simple cycle combustion gas turbines. Of the five prohibitory rules reviewed, the SJVUAPCD prohibitory rule for combustion gas turbines is the only one that includes an emission limit for CO (200 ppmv @ 15% O_2). Generic prohibitory rules (i.e., not device specific) from each of these districts were also reviewed; emission limits are 2000 ppmv at actual operating conditions.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT determination for natural gas-fired simple cycle combustion gas turbines, obtained from CARB's Guidance for Power Plant Sitting and Best Available Control Technology, reflects the most stringent CO emission limit. Therefore, BACT for CO emissions from natural gas-fired simple cycle combustion gas turbines is 6 ppmv @ 15% O_2.

C. Volatile Organic Compounds – Combustion Gas Turbine

The BACT analysis performed for VOC control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle combustion gas turbines;
- Review of federal NSPS for natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle combustion gas turbines.

1. Published BACT Guidelines

As discussed previously in Section IV.A.1, published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- CARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

CARB's BACT Clearinghouse contained SMAQMD determinations that specified an oxidation catalyst achieving an emission limit of 2.1 ppmv @ 15% O_2 as BACT for the following facilities:

- Carson Energy Group cogeneration plant in Sacramento, California; and
- Sacramento Cogeneration Authority cogeneration plant in Sacramento, California.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a VOC limit of 2 ppmv @ 15% O_2 has been "achieved in practice." This BACT guideline was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999).

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a VOC exhaust concentration of 2.0 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

The SCAQMD database did not contain BACT guidelines for VOC emissions from natural gas-fired simple cycle combustion gas turbines.

2. Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in Title 40 CFR Part 60 Subpart GG. This NSPS does not specify an emission limit for VOC.

3. District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, SDCAPCD, SJVUAPCD, and SCAQMD were reviewed to identify the VOC standards that govern existing natural gas-fired simple cycle combustion gas turbines. None of the prohibitory rules for combustion gas turbines, discussed previously in Section IV.A.3, specify an emission limit for VOC. Generic prohibitory rules (i.e., not device specific) from each of these districts were also reviewed; none contain an emission limit for VOC.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT determination for natural gas-fired simple cycle combustion gas turbines, obtained from CARB's Guidance for Power Plant Sitting and Best Available Control Technology, reflects the most stringent VOC emission limit. The BAAQMD established VOC emission limits of 2 ppmv @ 15% O_2 for natural gas-fired simple cycle combustion gas turbines. Therefore, BACT for VOC emissions from natural gas-fired simple cycle combustion gas turbines is 2 ppmv @ 15% O_2.

D. Particulate Matter Less Than 10 Microns in Diameter (PM_{10}) – Combustion Gas Turbine

The following tasks were performed for the PM_{10} BACT analysis:

- Reviewed published BACT guidelines for small natural gas-fired simple cycle combustion turbines;
- Reviewed federal NSPS for small natural gas-fired simple cycle combustion gas turbines; and
- Reviewed published prohibitory rules for small natural gas-fired simple cycle combustion gas turbines.

1. Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- CARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The CARB BACT Clearinghouse, as well as the BAAQMD and SJVUAPCD BACT guidelines, identify the use of natural gas as the primary fuel as "achieved in practice" for the control of PM_{10} for small simple cycle combustion gas turbines.

The SCAQMD database contained BACT determinations for the Los Angeles Department of Power and Water plant in Sun Valley, CA, and the Indigo Energy Facility in North Palm Springs, CA. The SCAQMD concluded that an exhaust PM_{10} concentration of 0.01 gr/dscf constituted BACT.

2. Federal NSPS

Title 40 CFR Part 60 Subpart GG contains the applicable NSPS for combustion gas turbines. Section III.H previously identified the requirements of Subpart GG applicable to the proposed combustion gas turbine; Subpart GG does not regulate PM_{10} emissions.

3. District Prohibitory Rules

Published prohibitory rules from the District, SCAQMD, SJVUAPCD, SMAQMD, and SDCAPCD were reviewed to identify the PM_{10} standards that govern existing small natural gas-fired combustion gas turbines:

- BAAQMD adopted Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 9-9 does not regulate PM_{10} emissions.

- BAAQMD Regulation 6 (Particulate Matter and Visible Emissions) specifies a PM emission limit of 0.15 gr/dscf for sources of PM emissions.

- The SMAQMD adopted Rule 413 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 413 does not regulate PM_{10} emissions.

- SMAQMD Rule 404 (Particulate Matter) specifies a PM emission limit of 0.1 gr/dscf for sources of PM emissions.

- SMAQMD Rule 406 (Specific Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.

- The SDCAPCD adopted Rule 69.3.1 (Stationary Gas Turbine Engines – Best Available Retrofit Control Technology) to limit NOx emissions from these devices. Rule 69.3.1 does not regulate PM_{10} emissions.

- SDCAPCD Rule 52 (Particulate Matter) specifies a PM_{10} emission limit of 0.1 gr/dscf for sources of PM emissions.

- SDCAPCD Rule 53 (Specific Air Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.

- The SJVUAPCD adopted Rule 4703 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 4703 does not regulate PM_{10} emissions.

- SJVUAPCD Rule 4201 (Particulate Matter - Concentration) specifies a PM emission limit of 0.1 gr/dscf for sources of PM emissions.

- SJVUAPCD Rule 4301 (Fuel Burning Equipment) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.

- The SCAQMD adopted Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 1134 does not regulate PM_{10} emissions.

- SCAQMD Rule 404 (Particulate Matter - Concentration) specifies a PM emission limit of 0.0437 gr/dscf for sources of PM emissions.

- SCAQMD Rule 409 (Combustion Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT guideline reflects the most stringent PM_{10} emission limit. The District established a requirement for the use of natural gas as the primary fuel to control PM_{10} emissions from combustion gas turbines. Therefore, the use of natural gas as the primary fuel source constitutes BACT for PM_{10} emissions from small simple cycle combustion gas turbines.

E. Sulfur Oxides – Combustion Gas Turbine

The following tasks were performed for the SOx BACT analysis:

- Reviewed published BACT guidelines for small natural gas-fired simple cycle combustion turbines;
- Reviewed federal NSPS for small natural gas-fired simple cycle combustion gas turbines; and
- Reviewed published prohibitory rules for small natural gas-fired simple cycle combustion gas turbines.

1. Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- CARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The CARB BACT Clearinghouse, as well as the BAAQMD and SJVUAPCD BACT guidelines, identify the use of PUC-quality natural gas or natural gas with a limit on the sulfur content (i.e., 1 grain/100 scf) as the primary fuel as "achieved in practice" for the control of SOx for small simple cycle combustion gas turbines. The two most recent BACT determinations in the SCAQMD did not indicate BACT for SOx.

2. Federal NSPS

Title 40 CFR Part 60 Subpart GG contains the applicable NSPS for combustion gas turbines. Section III.B previously identified the requirements of Subpart GG applicable to the proposed combustion gas turbine. A combustion gas turbine is subject to a SO_2 emission limit of 0.015% by volume (150 ppmv) @ 15% O_2. The NSPS also limits the sulfur content of fuel to 0.8% by weight.

3. District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the SO_2 standards that govern existing gas turbines.

- BAAQMD Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) is the BAAQMD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The BAAQMD adopted Rule 9-1 (Sulfur Dioxide) to limit SO_2 emissions from all sources. Rule 9-1 prohibits SO_2 emissions in excess of 300 ppm. No other BAAQMD Rule or Regulation contains a relevant prohibitory rule regulating either the sulfur content in the fuel or the emission of SO_2 from gas turbines.

- SJVUAPCD Rule 4703 (Stationary Gas Turbines) is the SJVUAPCD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The SJVUAPCD adopted Rule 4301 (Fuel Burning Equipment) to limit SO_2 emissions from these devices. Rule 4301 specifies a SO_2 emission limit of 200 pounds per hour. The SJVUAPCD also adopted Rule 4801 (Sulfur Compounds) to limit emissions of sulfur compounds. Rule 4801 specifies a SO_2 emission limit of 0.2%, or 2,000 ppm.

- SCAQMD Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) is the SCAQMD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The SCAQMD adopted Rule 431.1 (Sulfur Content of Gaseous Fuels) to reduce SOx emissions from the burning of gaseous fuels in stationary equipment. Rule 431.1 specifies a sulfur limit of 16 grains/100 scf (as H_2S) in natural gas sold within the SCAQMD. The SCAQMD also adopted Rule 407 (Liquid and Gaseous Air Contaminants) to limit SO_2 emissions from all sources. Rule 407 specifies an emission limit of 2,000 ppm for sulfur compounds (calculated as SO_2).

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the CARB database and BAAQMD and SJVUAPCD BACT guidelines reflect the most stringent SOx emission limit. These sources established a requirement for the use of natural gas as the primary fuel to control SOx emissions from combustion gas turbines. Therefore, the use of natural gas as the primary fuel source constitutes BACT for SOx emissions from small simple cycle combustion gas turbines.

F. Summary

The criteria that constitute BACT for the proposed natural gas-fired simple cycle combustion gas turbine are summarized in Table 8.1G-1 and compared against the design criteria for the proposed combustion gas turbine.

Table 8.1G-1
Summary of Emission Limits and BACT Requirements

Pollutant	BACT	Proposed Control Level
NOx	Emission Limit = 3.0 ppmv @ 15% O_2	Design Exhaust Concentration = 2.5 ppmv @ 15% O_2
CO	Emission Limit = 6 ppmv @ 15% O_2	Design Exhaust Concentration = 6 ppmv @ 15% O_2
VOC	Emission Limit = 2 ppmv @ 15% O_2	Design Exhaust Concentration = 2 ppmv @ 15% O_2
SOx	Natural gas fuel	Natural gas fuel
PM_{10}	Natural gas fuel	Natural gas fuel